GERTSCH

INSTRUCTION BOOK
FOR MODEL VM-1
PEAK READING
VACUUM TUBE VOLTMETER

520-01206

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DEPT. 10-42

ELECTRONIC INSTRUMENTS

GERTSCH
PRECISION ELECTRONIC INSTRUMENTS

GERTSCH PRODUCTS, INC.

MISSISSIPPI AVENUE • LOS ANGELES 25, CALIFORNIA • BRADSHAW 2-0568 • GRANITE 8-7777

MAILING ADDRESS: P. O. BOX 25856, W. LOS ANGELES 25, CALIFORNIA

WARRANTY POLICY

Gertsch Products, Inc. guarantees any equipment which we manufacture to meet the advertised performance specifications applying to that particular equipment.

Gertsch Products, Inc. warrants each instrument of its manufacture to be free from defects in material and workmanship. Our obligation under this Warranty is limited to servicing or adjusting any instrument returned to our factory for that purpose, and to making good at our factory any part or parts thereof except tubes, fuses or batteries which shall, within one year after making delivery to the original purchaser, be returned to us with transportation charges prepaid, and which on our examination shall disclose to our satisfaction to have been thus defective.

Gertsch Products, Inc. reserves the right to make changes in design at any time without incurring any obligation to install same on units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of Gertsch Products, Inc., and Gertsch Products, Inc. neither assumes nor authorizes any other person to assume for them any other liability in connection with the sales of Gertsch Products, Inc. instruments.

This Warranty applies only to the original purchaser unless approval for resale is obtained in writing from Gertsch Products, Inc.

Equipment _____

Serial No. _____

Sold To _____

Date Sold _____

WEST COAST ELECTRONIC MANUFACTURERS ASSOCIATION

INSTRUCTION BOOK

For

MODEL VM-1

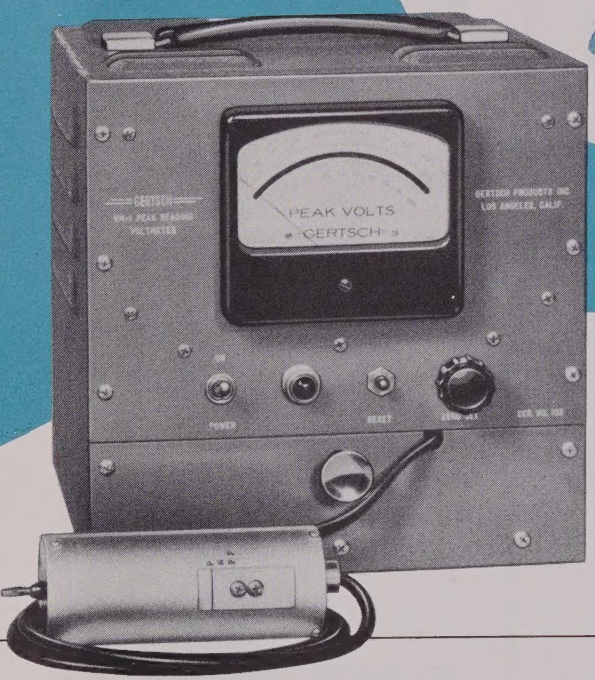
PEAK READING
VACUUM TUBE VOLTMETER

GERTSCH PRODUCTS, INC.
11846 Mississippi Avenue
Los Angeles 25, California

GERTSCH

MODEL VM1

Peak Reading Pulse Voltmeter



ACCURATE PULSE VACUUM TUBE VOLTMETER

MODEL VM-1

Basic instrument, including probe, 100V. full scale. Multipliers are required for higher voltage ranges. (See reverse side.)

The Model VM-1 is a true peak reading vacuum tube voltmeter. It is capable of measurement of repeated pulses with very short duty cycles. Provision is made to enable the measurement of positive peak, negative peak, or the peak to peak voltage of a waveform. The actual measuring elements are housed in a probe to allow direct connection to the voltage source with a minimum of shunt capacity and series inductance. Design of multipliers permits rapid selection of voltage ranges.

DETAILED SPECIFICATIONS ON REVERSE SIDE

FEATURES:

- Low duty cycle
- Wide bandwidth
- Positive, negative, peak to peak measurements
- Multipliers to 30Kv.
- Long discharge time
- Good shielding
- Portable
- Probe storage compartment

GERTSCH PRODUCTS, INC.

11846-48 Mississippi Avenue
Los Angeles 25, California
Phone BRadshaw 2-0568

GERTSCH

The circuitry in the VM-1 consists of a pair of diodes in the probe so arranged that they give a positive DC output voltage equal to the peak positive, negative, or peak to peak voltage being measured as selected by a switch on the probe. This voltage is fed to a stabilized feedback amplifier involving an electrometer tube which drives the indicating meter. The detector and amplifier circuits and components are of such a nature that the back resistance of the diode detector is greater than 10^{12} ohms. This gives an exceptionally long discharge time constant to the whole circuit. All critical voltages including the electrometer tube filament and diode filaments are regulated.

VM1 SPECIFICATIONS:

Voltage range: 100 V. full scale (see multipliers)

Min. duty cycle for 2% error: .000001

Frequency response: 50 cps to over 100mc.

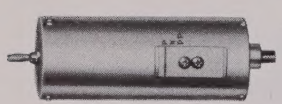
Input impedance: 13 uuf, 10 megohms

Accuracy: ±3% of full scale

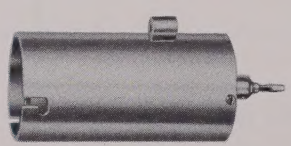
Power requirement: 105-125 V. 60 cycles

MULTIPLIER SPECIFICATIONS

TYPE	VOLTAGE RANGE	INPUT CAPACITANCE	FREQUENCY RESPONSE	ACCURACY WITH VM-1
VM1-A	300 v.	14 uuf.	50 cps – 40 mc.	± 5% Full Scale
VM1-B	1,000 v.	14 uuf.	50 cps – 40 mc.	± 5% Full Scale
VM1-C	3,000 v.	14 uuf.	350 cps – 40 mc.	± 5% Full Scale
VM1-D (2 Ranges)	10,000 v.	19 uuf.	105 cps – 20 mc.	± 5% Full Scale
	30,000 v.	19 uuf.	50 cps – 20 mc.	± 5% Full Scale



BASIC PROBE



TYPICAL VM1 – A, B & C MULTIPLIER

VM1-D MULTIPLIER

FOR FURTHER INFORMATION REGARDING THE MODEL VM-1 AND OTHER GERTSCH PRODUCTS, CONTACT THE FACTORY OR YOUR NEAREST GERTSCH ENGINEERING REPRESENTATIVE.

REPRESENTED BY:

LITHO IN USA BY PARKER ENTERPRISES, INC.

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SECTION I - GENERAL DESCRIPTION

1. GENERAL

This instrument is designed to permit accurate measurement of repeated pulses with very low duty cycles. It is capable of measuring positive or negative pulses or the peak to peak voltage of a wave form. A probe is provided to allow direct connection to the voltage source with a minimum of shunt capacity and series inductance.

2. PHYSICAL DESCRIPTION

The VM-1 is normally furnished in an aluminum carrying case with the following weight and dimensions:

Height - 10 1/2"	Depth - 9 3/4"
Width - 9 3/4"	Weight - 14 1/4 lbs.

A cylindrical probe 2" in diameter by 5 1/4" long is housed in the lower compartment of the case. A 5' cable connects this probe to the instrument. A slide action switch is provided on the probe to alter the circuitry for measuring positive or negative peak voltages or peak to peak voltages.

3. FUNCTION

Two diodes are located in the probe. One diode is used as a series detector in measuring positive peaks. The other diode is used as a shunt detector for measuring negative peaks. Both diodes are used in a voltage doubler circuit for measuring peak to peak voltages. The probe circuitry is capacitively coupled to an input terminal so that DC components are rejected. The output of the diode circuit is used to charge two polystyrene capacitors. An electrometer tube is used to measure the voltage on the capacitors. The cathode current of the electrometer tube passes through the meter movement. A second vacuum tube circuit is used to keep the plate cathode voltage of the electrometer tube approximately constant. This greatly reduces the errors inherent in the circuit.

4. PERFORMANCE CHARACTERISTICS

1. Range: 100 volts full scale (plug in multipliers are used to extend this to 30 kv).

2. Duty Cycle: Pulses with duty cycles as low as .000001 can be measured directly.

3. Frequency Response: 50 cycles to over 100 mc.

4. Input Impedance: 15 uuf., 10 megohms.

5. Accuracy: 3% full scale, 5% of full scale when multipliers are used.

6. Power Requirements: 105 - 125 volts, 60 cycles.

5. PULSE RESPONSE

A. The VM-1 measures positive peak, negative peak, or peak to peak voltages after rejecting any DC component. This means that positive or negative peaks are measured from the DC average voltage. (See Figure 1.)

B. The instrument will respond to the peak voltage of a spike which extends above a broader pulse, providing the duty cycle of the spike is not too low. Several minutes may be required for the instrument to charge to its final value if very narrow spikes at low duty cycle are measured. If the duty cycle is greater than 1 part in 10^6, the final reading will not vary with duty cycle by more than 1%.

C. The frequency response of the probe is flat within 1% from 50 cps to over 40 mc, with reasonably uniform response to over 100 mc. Errors will be introduced if the waveform being measured has appreciable amounts of energy in frequency components outside this range.

6. MULTIPLIERS

Plug-in multipliers are used to extend the range of the instrument to higher voltages. Separate units are used for full scale voltages of 300, 1000, and 3,000 volts, and a switched unit is used for 10,000 volts and 30,000 volts. The 300 and 1000 volt multipliers contain resistors and capacitors, and do not limit the frequency response at either end. The 3000 volt multiplier and the 10 kv - 30 kv unit are uncompensated capacity dividers. The low frequency 1% error points are as follows:

Full Scale Voltage	Low Frequency 1% Point
3,000	400 cps
10,000	100 cps
30,000	40 cps

Input capacity is approximately 15 uuf. for all dividers.

SECTION II - OPERATION AND ADJUSTMENT

1. WARM UP

Turn on the instrument and allow it to warm up about five minutes before use. The meter will drift slowly until the instrument is properly warmed up.

2. ZERO SET

Short the probe or multiplier input and set the circuit selector switch on the probe to the desired polarity. The zero set procedure should be repeated when the position of this switch is changed. Depress the reset button firmly for about 1 second and release. After releasing the reset button the meter will drift slowly for 10 or 15 seconds due to charging of the storage capacitors by the emission velocity current of the diodes in the probe. When this drift stops, turn the zero set knob until the meter reads zero. Remove the short from the input. The instrument is now ready for use.

3. CONNECTIONS

Connect the input and ground terminal of the probe or multiplier to the source to be measured. If high frequency components are involved, use the shortest possible leads in order to minimize stray capacity and stray inductance.

4. MEASUREMENT

Energize the source. Press the reset button on the instrument firmly and release. Wait until the meter settles at its final value and read. It must be remembered that this instrument will not follow a decrease in the input voltage. If the input decreases, the reset button must be pressed to obtain a new reading. When working with very slow duty cycles it will take a long time for the meter to come to the full peak reading. All measurements must be made with the circuit under test in a steady state condition. If any transients occur, the readings should be rechecked.

SECTION III - THEORY OF OPERATION

1. PROBE

The input is capacitively coupled to two diodes. One diode is used as a series detector in measuring positive pulses, the other is used as a shunt detector in measuring negative pulses, and both are used in a voltage doubler circuit for the measurement of peak to peak voltages. A lucite insulated slide action switch is used to make the necessary circuit changes. The diode section is used to charge polystyrene insulated capacitors in a pi section filter network. Several small resistors are used in the diode circuit to suppress resonances of the leads in the VHF range. A special filament transformer in the probe is used to provide heater power for the two diodes. This is necessary to prevent discharge of the storage capacitors through the heater-cathode leakage of the tubes. A polyethylene insulated cable is used to connect the probe output to the main instrument chassis. The leakage resistance of all components associated with the probe output is extremely high. Materials were chosen which do not form continuous moisture films under conditions of high atmospheric humidity. The operation of the instrument is not affected by normal humidity changes.

2. ELECTROMETER CIRCUIT

The output of the probe is fed to the grid of an electrometer tube located under the main chassis. The output capacitor of the pi section filter and the switch used to discharge the storage capacitors are located here. The cathode of the electrometer tube is connected to the meter movement through multiplier resistors. A wire wound potentiometer is included in this circuit for calibration of the instrument. A small amount of current flows through the electrometer tube even when the grid is at zero voltage. To cancel this and to offset the instrument for the contact potential introduced by the diodes, the zero set control is arranged to control a current which flows through the meter in the opposite direction. The electrometer tube heater power is obtained from a small floating DC regulated supply. A selenium rectifier and gas tube regulator are used.

3. ELECTROMETER PLATE SUPPLY

The electrometer tube draws its plate current through V5, a dual triode. The same floating power supply which supplies heater power to the electrometer tube is also used to provide a constant potential difference between the electrometer tube cathode and the grids of V5. An ordinary grounded power supply is used to provide plate voltage for V 5. The function of this circuit is to maintain a nearly constant potential difference between the plate and cathode of the electrometer tube. This

improves the accuracy of the instrument by reducing the change in grid voltage required to drive the instrument. If the electrometer tube were supplied from a constant voltage source, a potential of at least 120 volts would be required. If the grid were at zero voltage under these conditions, the cathode follower would reach equalibrium with a fairly large voltage on the cathode. With the circuit employed in this instrument, a potential of about 20 volts exists across the electrometer tube at all times. With the grid at zero, only a small positive cathode voltage is necessary to reach equalibrium. The cathode, therefore, follows the grid more closely with this circuit.

4. POWER SUPPLIES

A 300 volt regulated supply is used to supply B+ to the instrument. This consists of a power transformer, a 5Y3 rectifier, a pi section RC filter, and a regulator consisting of 2 type OA2 gas filled regulator tubes. The negative end of this supply passes through R104, the zero set control. This gives a small negative output which is used to obtain an essentially constant current through R113 and M101 to cancel the residual current through the electrometer cathode follower at zero input voltage. A second regulated DC supply consisting of a transformer, a selenium rectifier, a pi section LC filter and a type OB2 regulator is used to provide heater current for the electrometer tube. This supply also is used as a reference to establish the proper potential difference across the electrometer tube as explained in Part 3 of this section. This is a floating power supply and it has no DC connection to ground except through the electrometer tube circuit. No current from this supply flows through ground. There is also a regulated AC supply for the diode heaters in the probe. Two 6.3 volt filament windings are connected in series to provide a 12.6 volt source for the filament regulator. Tube V4, a type 3TF4 ballast tube, is used to provide an essentially constant current source. Part of this current flows through the filament transformer in the probe. The rest of it is diverted through R105 and R106 which make up a variable shunt. By varying R105, the voltage across the filament transformer can be brough to exactly 6.3 volts. This produces 1.35 volts at the secondaries of the transformer and the heaters of the diodes.

SECTION IV - MAINTENANCE

1. TROUBLE SHOOTING

Most troubles may be located by visual inspection and by proper use of a volt-ohmmeter. Care should be taken when working with the electrometer tube since many ohmmeters produce sufficient current on low ranges to burn out the heater of this tube. The two DC regulated power supplies may be checked by the glow in the regulator tubes. If no glow is observed in any of the tubes the volt ohmmeter should be used to locate the faulty component. A red glow should be observed on at least part of the coiled resistance wire in V4, the ballast tube. Check the ballast tube for continuity if no glow is observed. If the main power supply should fail, no deflection at all will be observed in the front panel meter. If V5 or V6 or the regulated electrometer filament supply should fail the meter will deflect off scale to the left and it will be impossible to bring the pointer to the right of zero by adjustment of zero set control.

The electrometer tube dissipates very little heat and cannot usually be checked by feeling the envelope. If trouble is suspected in this tube, the heater voltage should be checked. This tube is rated at 1.25 volts. If the heater should burn out, a very high voltage would be observed across the heater terminals. This would go to about 105 volts if a vacuum tube voltmeter were used.

If the rest of the instrument is working, the probe may usually be checked by coupling a voltage to its input terminal. In many locations an ungrounded person touching the input terminal will produce sufficient 60 cycle signal. When doing this, always press the reset button and observe the performance after it is released. If either diode is not working, the instrument will not respond to a signal in the peak to peak position. If V9 is not working, the instrument will not respond in the negative position. If V8 is not working it will not respond in the positive position. If it will not work in any position, the diode filament supply may be at fault. The diodes used in the probe are treated with wax to prevent the formation of moisture films from atmospheric humidity. These tubes are carefully scrubbed with alcohol and dipped in wax. The resistance between plate and cathode pins is then checked with a special megohm meter and tubes showing less than 1 million megohms are rejected. Unless facilities for doing this are available, replacement tubes should be obtained from Gertsch Products, Inc. In an emergency, a tube may be cleaned, dipped and then tested in the probe. To do this, insert the tube in the probe and apply a voltage which will drive the meter to full scale. Disconnect the input voltage and time the discharge. If the meter loses more than 1% in two minutes,

the leakage is excessive and the tube should be rejected. Repeat this check with each of the three positions of the probe switch. The leakage resistance measured at the co-axial cable at the output of the probe should be close to 1 million megohms, which is too high to be measured with most equipment. Leakage in this section will cause abnormally rapid decay of the meter reading after the input signal is removed. It is possible to locate leakage in the high resistance section by disconnecting components from the grid of the electrometer tube one at a time. If the trouble cannot readily be isolated in this manner, the instrument should be returned to the factory.

2. CALIBRATION

To calibrate the VM-1 it is necessary to have the following equipment:

A. 0-100 V, AC thermocouple or dynamometer type meter accurate to ± 1%.

B. Source of 75 volts, 400 cycles with less than 1% distortion and good voltage stability.

Place the selector switch on the probe to positive. Carefully zero set the VM-1. Connect the standard meter and the VM-1 both to the source. Adjust the voltage to 70.7 volts RMS as indicated by the Standard meter. Press the reset button on the VM-1. Allow about 10 seconds for steady state to be reached and adjust the calibration control, R112, for full scale reading of 100 volts peak. Repeat the process to make certain that transients have not caused error. Set the voltage to 35.35V RMS and check to see if the positive peak reading plus the negative peak reading equals the peak to peak reading.

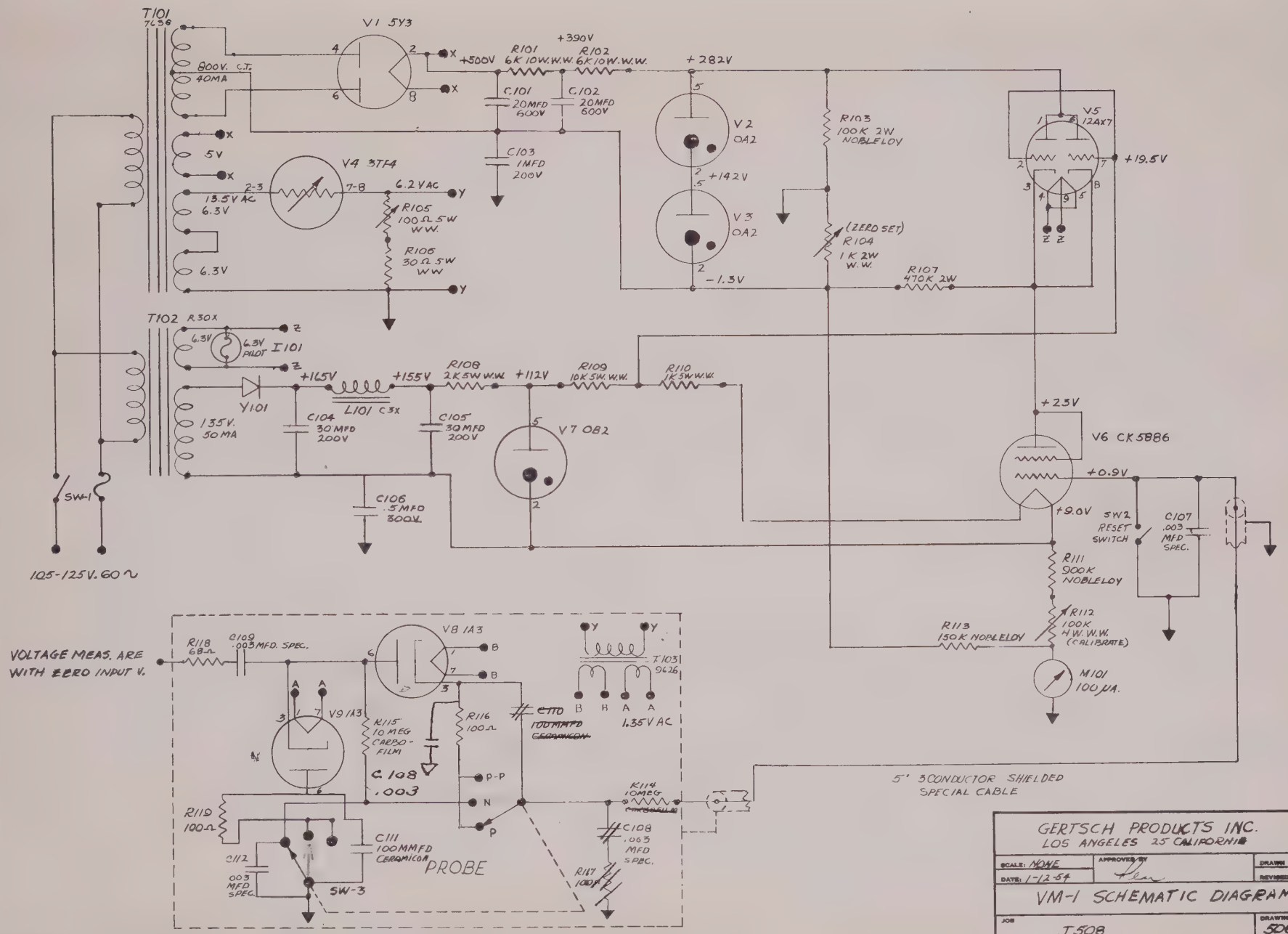
SECTION V - PARTS LIST

Circuit Ref.	Description
R101	Resistor: wire wound, 6000 ohm, ± 10%, 10 watt.
R102	Resistor: wire wound, 6000 ohm, ± 10%, 10 watt.
R103	Resistor: nobleloy, 100 k, ± 1%, 2 watt.
R104	Potentiometer: wire wound, 1000 ohm, 1 watt.
R105	Potentiometer: wire wound, 100 ohm, 5 watt.
R106	Resistor: wire wound, 30 ohms, ± 10%, 5 watt.
R107	Resistor: composition, 470 k, ± 10%, 2 watt.
R108	Resistor: wire wound, 2000 ohms, ± 10%, 5 watt.
R109	Resistor: wire wound, 10,000 ohms, ± 10%, 5 watt.
R110	Resistor: wire wound, 1000 ohm, ± 10%, 5 watt.
R111	Resistor: nobleloy, 900 k, ± 10%, 2 watt.
R112	Potentiometer: wire wound, 100 k, ± 10%, 4 watt.
R113	Resistor: nobleloy, 150 k, ± 1%, 1 watt.

Circuit Ref.	Description
R114	Resistor: ~~carbofilm,~~ COMPOSITION, 10 megohm, ~~± 1%, 1 watt.~~
R115	Resistor: carbofilm, 10 megohm, ± 1%, 1 watt.
R116	Resistor: composition, 100 ohm, ± 10%, 1/2 watt.
~~R117~~	~~Resistor: composition, 100 ohm, ± 10%, 1/2 watt.~~
R118	Resistor: composition, 68 ohm, ± 10%, 1/2 watt.
R119	Resistor: composition, 100 ohm, ± 10%, 1/2 watt.
C101	Capacitor: electrolytic, 20 ufd, 600 wvdc.
C102	Capacitor: electrolytic, 20 ufd, 600 wvdc.
C103	Capacitor: paper, 1 ufd, 200 wvdc.
C104, C105	Capacitor: electrolytic, dual, 30-30 ufd., 200 wvdc.
C106	Capacitor: paper, .5 ufd, 300 wvdc.
C107	Capacitor: polystyrene, .003 ufd., special.
C108	Capacitor: polystyrene, .003 ufd., special.
C109	Capacitor: polystyrene, .003 ufd., special.

Circuit Ref.	Description
~~C110~~	~~Capacitor: ceramic, 100 uufd, 500 wvdc.~~
C111	Capacitor: ceramic, 100 uufd, 500 wvdc.
C112	Capacitor: polystyrene, .003 uufd, special.
T101	Transformer: power, Triad 7636 special.
T102	Transformer: power, Triad R30X.
T103	Transformer: filament, Triad 9626, special.
L101	Inductor: filter choke, Triad C-3X.
SW1	Switch: SPST, Toggle.
SW2	Switch: SPST, polystyrene, Special.
SW3	Switch: Lucite, Special.
Y101	Rectifier: selenium, DF30, Sarkes Tarzian.
V1	Tube, 5Y3
V2	Tube, OA2
V3	Tube, OA2

Circuit Ref.	Description
V4	Tube, Ballast 3TF4
V5	Tube, 12AX7
V6	Tube, Electrometer, CK5886
V7	Tube, OB2
V8	Tube, 1A3 Special
V9	Tube, 1A3 Special
I101	Pilot Lamp 6.3 volt, type 51.
M101	Meter Movement Triplett 100 ua GPI Special.



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VM-1 SCHEMATIC DIAGRAM

JOB	DRAWING NUMBER
J-508	508-100

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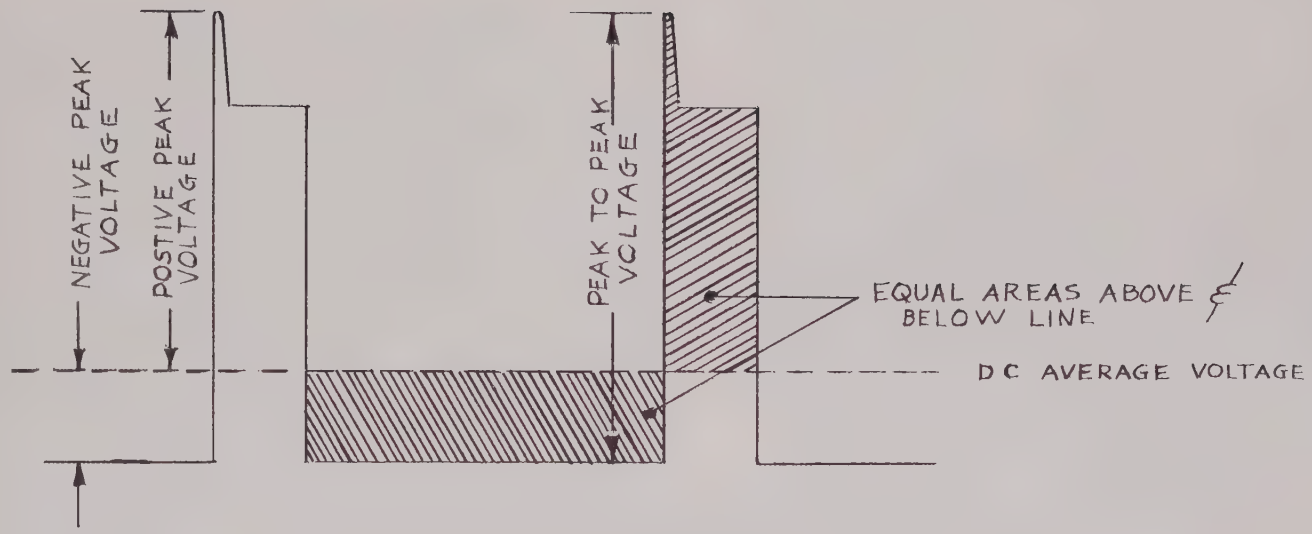

FIGURE 1

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VM-1 TYPICAL WAVEFORM		
JOB 508		DRAWING NUMBER 508-17

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GERTSCH

SHORT FORM CATALOG #2

PRECISION ELECTRONIC INSTRUMENTS

Frequency Measuring Equipment

L.F. through Microwave, 100 kilocycles to 12,500 megacycles

Standard Ratio Transformers

AC voltage dividers, capable of extreme accuracy and resolution in measurement and generation of AC voltage ratios

Peak Reading Volt Meters

Wide band, peak reading vacuum tube voltmeters

Deviation Meters

Completely transistorized Peak Modulation Deviation Meters, continuous coverage from 20 to 640 mc.

Special Purpose Transformers

Bridge Transformers and Unity Ratio Phase Inverting Transformers designed for use with Standard Ratio Transformers

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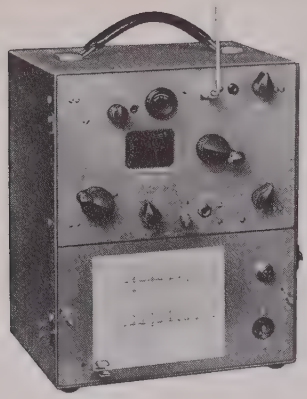


FM-3

VHF FREQUENCY METER - FM-3

Direct reading VHF frequency meter, known as the standard of the industry. Extremely accurate and stable units (.001%), designed for measurement and generation of frequencies. Basic frequency range is 20 to 40 mc. Using harmonics, the FM-3 will measure and generate frequencies from 20 to 640 mc. and up to 1000 mc. under certain conditions, with continuous coverage over the entire range. Also frequencies down to 1 mc. can be measured. May be used to set peak deviation on FM transmitters.

Direct reading, with no calibration book necessary. Exceeds FCC requirements for accuracy and stability. May be standardized against W.W.V. Internal 1 kc. modulation. Available in convenient portable case with handle, or for rack mounting.

Model FM-3 (battery operated)	$687.50
Model FM-3/PS-3 (AC power operated)	742.50
Model FM-3R (rack mounted - without cabinet)	764.50
Model FM-3R (rack mounted - with case)	794.50
Model PS-3 Power Supply	50.00
Model PS-3C Power Supply	55.00

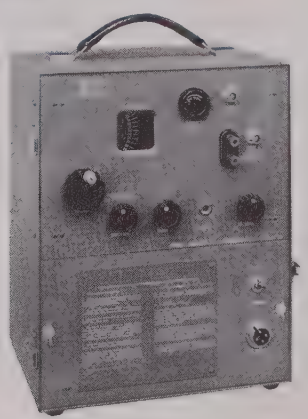
FM-4

MICROWAVE FREQUENCY MULTIPLIER - FM-4

Capable of measuring and generating frequencies in the UHF and microwave regions with a high degree of accuracy. It requires an auxiliary driving source such as the FM-3 or the AM-1 shown on this page. Basic frequency range is 500 to 1000 mc. Using harmonics, it will measure and generate frequencies from 500 to 12,500 megacycles with continuous coverage. Using special techniques, operation well above 12,500 mc. can be obtained. It will measure frequencies down to 100 mc.

The accuracy and stability is primarily a function of the driving unit. For example, when driven by the FM-3, the accuracy and stability are .001%. When driven by the AM-1, with proper auxiliary equipment, accuracy and stability are as good as .00001%.

Model FM-4 (shown)	$1,650.00
Model FM-4R (rack mounted)	1,650.00



FM-5

FREQUENCY DIVIDER - FM-5

The Model FM-5, when driven by a VHF frequency meter, is capable of measuring or generating frequencies in the "low" through "high" frequencies with a high degree of accuracy. It is designed specifically to extend the frequency measuring range of either the FM-3 or AM-1 down to 50 kc. and the frequency generating range down to 200 kc. with no loss in accuracy. Measures and generates up to 20 mc. with continuous coverage.

Accuracy and stability of the FM-5, when driven by the FM-3, is .001%. When used with the AM-1, and suitable auxiliary equipment, accuracy and stability are .00001%.

Model FM-5 (shown)	$425.00
Model FM-5/PS-3 (AC power operated)	485.00
Model FM-5R (rack mounted model with metal case)	530.00
Model FM-5R (rack mounted model without metal case)	500.00

AM-1

VHF INTERPOLATOR - AM-1

Auxiliary equipment designed primarily to extend the range of existing frequency standards. Using harmonics, it is capable of measuring and generating any frequency within the range of 20 to 1000 mc. It requires, for operation, (1) input from a 100 kc. standard and (2) equipment to measure accurately frequencies between 1 and 2 megacycles, such as a counter.

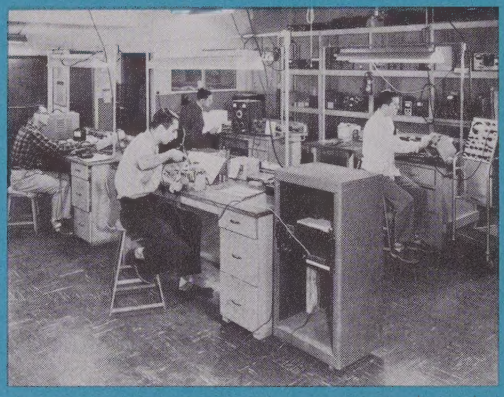
Its accuracy and stability are primarily a function of the 100 kc. source and the 1 to 2 mc. measuring equipment. Accuracies as good as 1 part in 10^7 (1 cycle in 10 megacycles) can be obtained. Ultimate accuracy approaches 1 part in 10^8.

Model AM-1	$1,500.00

GERTSCH

where skilled engineering produces precision performance

At Gertsch Products, we devote all of our time to the development and production of precision electronic instruments. Almost a quarter of our plant area and a full complement of engineers and scientists are employed in constant research and development of new devices which will provide the engineer with better development instruments and the production line with more adequate test equipment. Before we ever produce a new instrument it is first tested completely in our own plant, then field tested to be sure its operation meets the original specifications.

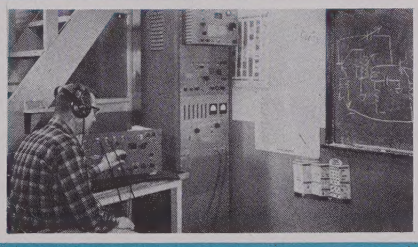


DESIGNING NEW INSTRUMENTS

Our engineering staff spends many months on the design of new equipment before putting it into actual production. The staff is made up of qualified engineers, with experience in all types of electronic equipment. Each member has had research and development experience as well as production experience.

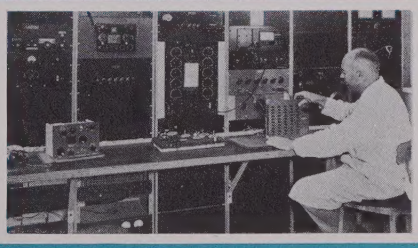
PERFECTING PRESENT INSTRUMENTS

The Gertsch line of precision electronic instruments is relatively small, but it is complete in each category. Our Frequency Meter line, started with only one instrument, has now grown to four, with variations in specifications and physical make-up of each available to fit every conceivable requirement. Our Standard Ratio Transformer line includes nine models and each is available in several case configurations.



PLANNING NEW TECHNIQUES

We are in constant touch with the industry's new developments and work them into present production of listed instruments as well as in the devices being planned. Newest techniques, use of transistors, and the ruggedization of equipment have been incorporated in the present Gertsch instruments. Many more are in the planning stages.



PRODUCING QUALITY EQUIPMENT

Our engineering department has developed a complete set of test equipment for checking all Gertsch instruments produced. It is a complete test rack and is capable of testing our regular schedule of production as well as almost any special instruments which we might be called upon to produce. In-line tests are made of all sub-assemblies. Incoming inspection is made on a 100% basis for all critical items.

SPECIAL PURPOSE TRANSFORMERS

● BRIDGE TRANSFORMERS

The Models 100 and 100A Double Shielded Transformers have been designed for use with the Gertsch Standard Ratio Transformers, to isolate the Null Detector from the Bridge. They also may be used in AC bridges, to isolate the Detector or Generator from the measuring network, or to provide a balanced output from an unbalanced generator. Other applications of Gertsch Bridge Transformers include use as step-up or step-down, or wherever isolation is desired.

In both models, each winding is individually shielded. In the Model 100A, the terminals are also shielded, resulting in complete electrostatic shielding of each winding. The 100A also has a mu metal shield to reduce the external hum pick-up to a minimum.

Model 100 ..... **$36.00**

Model 100A **85.00**

Specifications:

	MODEL 100	MODEL 100A
Turns ratio	4 to 1	4 to 1
Intershield capacitance	less than 25mmf	less than 30 mmf
Frequency range	20 - 5,000 cps	20 - 5,000 cps
DC Resistance, Lo Z	80 ohms	80 ohms
Hi Z	1800 ohms	1800 ohms
Insulation	500 V. test	500 V. test
Input voltage	115V. at 60 cps*	115V. at 60 cps*
Height	4 5/16"	4 5/16"
Width (with mounting)	3 11/16"	3 11/16"
Depth (without terminals)	4 1/2"	4 1/2"
Depth (with terminals)	4 7/8"	7 5/8"

* Into Hi Z winding for impedance larger than 100 Ohms across low Z winding

● UNITY RATIO PHASE INVERTING TRANSFORMERS

Model 200 designed for use with Gertsch Standard Ratio Transformers, to provide a phase shift of 180° to the input or output of the Ratio Transformer in certain bridge applications. No shields are supplied around windings. Use with one winding floating is not recommended.

Model 200 ..... **$54.00**

SPECIFICATIONS

Turns ratio:	1 to 1
Effective winding resistance:	10 Ohms
Effective leakage inductance:	2.5 mh
Open circuit ratio accuracy:	.005%
Open circuit phase error:	less than .03 milliradian at 400 cps
Voltage into windings:	E_{rms} Max. = .35 f (f is frequency in cps) not to exceed 170 V. RMS
Height:	4 5/16"
Width:	3 11/16"
Depth (without terminals):	4 1/2"
Depth (with terminals):	4 7/8"

● VOLTMETER CALIBRATION TRANSFORMERS

Model 201. Designed for calibrating vacuum tube voltmeters. **Input:** 300 volts RMS. 400 cps. **Outputs:** (V RMS) 300, 100, 30, 10, 3, 1.440 (equals 2.037 volts peak which is equal to 2 standard cells in series), 1.0, .8, .6, .4, .3, .2, .1, .03, .01, .003, .001. Accuracy of voltage ratios better than .01%. Enclosed in drawn aluminum can, with terminals. Overall size 6⅞" x 6⅞" x 4½" (high).

Model 201 ..... **$415.00**

● BP SERIES FILTERS

Passive filter units with extreme attenuation outside the pass band (at least 40 db) and sharp cut-off (attenuation rate 80 db per ½ octave). Can be used as low pass, high pass, or band pass.

BP-1 Range 37.5 - 13,600 cps. in half octave steps. Hi and Lo-pass sections can be used in tandem to provide band pass in multiples of ½ octave. 600 ohms. **$2,400.00**

BP-2 Similar to BP-1 but 10 - 160 kc. 135 ohms **1,500.00**

BP-3 Similar to BP-1 but 6.65 - 37.5 cps. 600 ohms **3,675.00**

PS-3 POWER SUPPLY

Regulated power supply for use with FM-3. Provides operation at either 110 or 220 volts. 50/60 cycles. **$50.00**

PS-3C POWER SUPPLY

Cased portable version of the PS-3. Used with FM-3 when both AC and battery operation are desired. **$55.00**

All data and prices are subject to change without notice. Prices shown are F.O.B. factory.

10-55 - LITHO IN U.S.A.

Prepared by Larson-Whittington Assoc., Inc.

Sales representatives in most principal cities of U.S. and Canada. Facilities for export available. For further information contact your nearest Gertsch representative or the factory.

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93118